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UTILITY APPLICATION FOR UNITED STATES PATENT

FOR

GAME SYSTEM WITH ENHANCED CONTROL FOR MOVING DISPLAYED VIRTUAL  
OBJECTS

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GAME SYSTEM WITH ENHANCED CONTROL FOR MOVING DISPLAYED  
VIRTUAL OBJECTS

This invention relates in general to input devices for simulators and electronic games, known particularly under the term "gamepads".

Gamepads known at the present time are provided with  
5 an electrical connecting cable leading to a game console input connector or to a computer, and the user needs to press on one or several buttons in order to move a character or a mobile object displayed on the screen in the required direction while executing the game.

10 This process requires a certain amount of learning by the user since displacement of the object is not intuitive. When a beginner (child or adult) is observed performing such manipulations, it can be seen that he is uncomfortable in making the actions of the finger(s)  
15 match the required displacement.

Specialised electronic game equipment is known capable of converting movements of portable equipment (virtual sword handle, headset) into electronic control actions. Documents US-6 162 123 A, EP-1 249 260 A,

US 2002/0175897 A and EP-1 060 772 A give examples of such equipment.

However, all these known approaches are relatively clumsy compared with dedicated games, typically "arcade" games for public locations, and they are complicated to use.

Furthermore, if it were required to use this equipment with several different types of games, dedicated actuators would have to be added and the necessary adaptations would have to be made.

This invention is designed to overcome these problems and to propose a standard, simple and economic input device for various types of electronic games, that can provoke displacements of an object or a mobile virtual character on the display screen in a particularly intuitive manner and is therefore easy to control, in addition to action controls such as displacement buttons usually provided on the input device.

Yet another purpose of the invention is to enable the use of directional displacement buttons that are conventional in themselves, but for which the action depends on the orientation of the gamepad with respect to the screen.

To achieve this, according to a first aspect, the invention proposes an electronic game system comprising a central processing unit, a display device and at least one universal displaceable input actuator that can be held in a player's hands and that can generate standard control information for a plurality of electronic game programs each of which can be executed by the processing unit, characterised in that it comprises means of transmitting/receiving signals between a fixed part of

the system and the said actuator, processing means capable of determining path time data for transmitted signals to generate one or more items of actuator position and / or orientation information, and control  
5 means that can apply commands based on the position and / or orientation information to the processing unit, to act on the displacement of virtual objects displayed on the display device.

The position information may be absolute or  
10 relative.

Some preferred but non-limitative aspects of this system are given below:

- the transmission/reception means provided on the fixed part of the system include transmitters or  
15 receivers provided close to the display device;

- the system comprises at least one receiver on the fixed part and at least one transmitter on the actuator, the said transmitter also being capable of transmitting actuator identification information to the central unit  
20 through the said receiver;

- the system also comprises a transmitter on the actuator capable of transmitting actuation information determined from an actuatable element provided on the actuator, through a receiver on the fixed part, to the  
25 central unit;

- the system comprises a plurality of transmitters on the fixed part and a plurality of receivers on the actuator;

- the processing means are capable of determining  
30 changes in the position of the actuator with respect to the fixed part, with five degrees of freedom;

- the processing means are capable of determining changes in the position of the actuator with respect to the fixed part, with six degrees of freedom;

- the actuator comprises three non-aligned transmitters or receivers.

According to a second aspect, the invention proposes a universal displaceable input actuator that can be held in a player's hands, to apply control signals to an electronic game system comprising a central processing unit and a display device, characterised in that it comprises means of transmitting signals by wireless transmission from at least two transmitters at a distance from each other on the actuator, the said transmitters transmitting distinct signals that can be used to determine the position and / or orientation of the actuator from at least two fixed receivers.

In one embodiment, the actuator comprises a displacement control part moving with respect to another part, the transmitters are fixed on the displacement control part, and at least one receiver is fixed on the said other part.

The invention also proposes a universal displaceable input actuator that can be held in a player's hands, to apply control signals to an electronic game system comprising a central processing unit and a display device, characterised in that it comprises means of reception of signals by wireless transmission at at least one receiver, the receiver being capable of receiving distinct signals transmitted by at least two fixed transmitters to enable determination of the actuator position and / or orientation.

In one embodiment, the actuator comprises a displacement control part that moves with respect to another part, in which the receiver or each receiver is fixed on the displacement control part, and in which at least one transmitter is fixed on the said other part.

Other aspects, purposes and advantages of this invention will become clearer after reading the following detailed description of preferred embodiments of the invention given as a non-limitative example and with reference to the appended drawings, wherein:

Figures 1a and 1b are perspective diagrams illustrating two example embodiments of the invention,

Figures 2a and 2b are perspective diagrams illustrating two embodiments of a gamepad according to the invention,

Figure 3 is a perspective diagrammatic overview of an electronic game platform and a set of gamepads,

Figure 4 is a view similar to Figure 3 with an additional gamepad, the gamepads being provided with directional control buttons,

Figure 5 is a functional diagram of an electronic part of a gamepad according to the invention,

Figure 6 is a functional diagram of a part of the electronics of a game platform capable of cooperating with such a gamepad,

Figure 7 is a more detailed functional diagram of this part of the electronics,

Figure 8 diagrammatically illustrates application of this invention to an input device of the virtual driver's steering wheel type, and

Figure 9 diagrammatically illustrates the application of the invention to a joystick type input device.

5 Firstly, note that the invention is particularly applicable to an electronic game platform like that described in document WO 02 20110 A issued by the applicant, but it is also equally applicable to electronic game systems with a vertical screen.

10 First with reference to Figure 1A, the Figure diagrammatically shows the display screen part D of an electronic game system such as action games, parlour games, etc., the screen in this case being approximately vertical and facing a player.

This system comprises four signal transmitters  $E_A$  to  $E_D$  (radio frequency, infrared, ultrasonic wave signals, etc.) capable of propagating at a determined speed as far as a gamepad M, preferably around the screen D. In fact, these transmitters are arranged in the region of the four corners of the screen D, but many other arrangements are possible.

20 In this case, the gamepad M is provided with two receivers  $R_1$  and  $R_2$  capable of receiving signals transmitted by the corresponding four transmitters, these receivers in this case being located in the region on the opposite sides of the gamepad, symmetrically about an axial plane of the gamepad.

Figure 1b illustrates the fact that the same system may be implemented with a display screen D, for example placed horizontally, as described in document WO 02 20110 A mentioned above.

30 Transmitters  $E_A$  to  $E_D$  output four distinct signals, that are listened to by receivers  $R_1$  and  $R_2$ .

It is known that the time that elapses between when a given signal is transmitted by one of the transmitters and when the same signal is received by one of the receivers is proportional to the distance between the transmitter and the receiver being considered. Therefore, the system is capable of determining the above-mentioned distance by processing the signal based on times of reception of the same signal transmitted by the different receivers. And the use of several transmitters and several receivers, and of a plurality of associated measured distances, provides a means of deducing the position and / or orientation of the gamepad M taken as a whole with respect to transmitters  $E_A$  to  $E_D$  and therefore with respect to the screen. In order to avoid making the description unnecessarily complicated, we will not describe the different calculations used to obtain the position and / or orientation data for the gamepad; these calculations make use of conventional geometry and those skilled in the art are quite familiar with them.

If this type of measurement is made at a high frequency, for example 10 to 100 times per second, the system determines the dynamic variation of distances and uses them to deduce the movements of the gamepad M made by the user with respect to the screen D.

In a first embodiment, the position and / or orientation calculations of the gamepad M are done in a processing unit located in the gamepad itself.

In a second embodiment, the gamepad simply transmits time data representing instants at which signals transmitted by transmitters  $E_A$  to  $E_D$  are received by receivers  $R_1$  and  $R_2$  to the game system, either through a wire link or a wireless link.

Note that the use of two receivers  $R_1$  and  $R_2$  located on opposite sides and the use of at least three transmitters is sufficient to calculate the position and the orientation of the gamepad with five degrees of freedom, as illustrated in Figure 2a in the drawings, namely a translation along three orthogonal axes  $x$ ,  $y$  and  $z$  (where  $z$  is the vertical,  $x$  is the lateral direction, and the  $y$  direction is forward / backward with respect to the user), and rotation about the  $y$  and  $z$  axes, and the only unknown that cannot be determined is rotation about the  $x$  axis parallel to the straight line joining the two receivers.

According to one variant, with reference to Figure 2b, translations / rotations in six possible degrees of freedom can be determined by providing a third receiver  $R_3$  on the gamepad  $M$ , provided that it is offset from the receivers  $R_1$  and  $R_2$  along the  $y$  axis and / or along the  $z$  axis. In fact, while receivers  $R_1$  and  $R_2$  are located at the left or right side at the "front" face of the gamepad (the face furthest from the user), the receiver  $R_3$  is at the middle of its opposite or back face.

Advantageously, the gamepad  $M$  also comprises one or several buttons (see  $B_1$  and  $B_2$  on the gamepad  $M_5$  in Figure 4), namely traditional buttons (directional buttons, joystick, action keys, etc.) and / or buttons that will have an influence on the process for determination of the initial position and the orientation of the gamepad  $M$ .

In particular, a button can be provided to activate / deactivate determination of the position of the gamepad according to the process described above.

As mentioned above, the gamepad  $M$  uses a preferably wireless connection to supply information about its

position with respect to the transmitters and therefore to the screen with reference to all or some of the six degrees of freedom, and actions or information necessary for operation of the system, to the electronic game system (platform, dedicated console or personal computer).

Advantageously, and now with reference to Figure 3, the system enables the use of several gamepads, in this case four gamepads  $M_1$  to  $M_4$ .

In this case, the communication of each gamepad with the system is differentiated (this is natural with a wire link, and for example it may be made simply by adding an identifier in transmitted messages). Thus, position data or time data transmitted by each gamepad to the central system are assigned to the corresponding gamepads.

There can be a very wide variety of actions to displace a virtual mobile object displayed on the screen D as a function of translation and / or rotation movements of the gamepad.

The following assignments may thus be made:

<u>Gamepad movement</u>	<u>Object movement</u>
Rotation /z	direct left right
Translation /y	accelerate / decelerate
Rotation /x	raise / lower
Translation /x	step on the side
Etc.	

As already mentioned, it may be desirable to keep a conventional control by directional buttons ( $B_1$  in figure 4) on the gamepad in cooperation with a screen arranged horizontally. In this case, the gamepad may be positioned along a predefined direction. Then, by action on a determined button, this horizontal position is memorised

so that actions on directional buttons act along directions that take account of the memorised position of the gamepad.

For example, in the case in Figure 4, it is assumed  
 5 that a fifth player with a gamepad  $M_5$  joins a group of four players using gamepads  $M_1$  to  $M_4$  respectively, on the same side of the electronic platform as the player with gamepad  $M_4$ .

Determination of the position of the gamepad  $M_5$  with  
 10 respect to the system makes it possible to organise the system such that when the fifth player uses the front / back / left / right directional buttons on his gamepad, the corresponding movements of the mobile object on screen D are made along the directions as observed from  
 15 the observation point of the said player.

According to one variant embodiment, signal transmitters can be located on the gamepads and the corresponding receivers can be fixed, preferably close to the screen. Thus, as illustrated in Figure 5, in this  
 20 case the gamepad M is provided with three transmitters  $E_1$  to  $E_3$  connected to three signal generators  $GS_1$  to  $GS_3$ , respectively.

Each gamepad sends different signals, so as to differentiate signals transmitted by several gamepads.

25 Figure 6 illustrates the region of the display screen D surrounded by four receivers  $R_A$  to  $R_D$  located in the region of its four corners. A decoder circuit is associated with each receiver, but only circuit  $DC_A$  associated with the receiver  $R_A$  is shown in the Figure.  
 30 Each decoder circuit is connected to a gamepad processing unit UTM that receives signals from the decoder circuits and generates position / orientation data for the

corresponding gamepads, used as input data in the associated game program.

Starting from time components contained in the received signals, the processing unit UTM dynamically  
5 calculates the distance between each transmitter and each receiver and uses these distances to calculate movements made by the user to generate input data to the game application executed by the system.

With this approach, transmitters located on gamepads  
10 are also advantageously used to transmit other information such as button manipulation events, joystick events, etc., also addressed to the game application.

As we have already said, the distance measurement may be made by different transmission techniques, and  
15 particularly using infrared, ultrasound, radio frequency signals, etc.

Preferably, if the transmitters are located on the gamepads M, each transmitter sends a pulse stream on a different frequency carrier, this pulse stream forming a  
20 specific code uniquely identifying the gamepad.

Thus, the carrier identifies the transmitter considered among the plurality of transmitters, while the pulses identify the gamepad.

At the receiver end, now with reference to Figure 7,  
25 each receiver comprises a sensor CPT chosen as a function of the technology considered, and a carrier decoder DP that separates the different carriers originating from each of the two or more transmitters.

There are also another three transmitter processing  
30 units denoted  $UTE_1$ ,  $UTE_2$  and  $UTE_3$ , each of which is capable of calculating the distance between the associated transmitter and the receiver considered.

Figure 8 shows a steering wheel type input device 10 for virtual racing, with a base 12 and a turning steering wheel 14. The steering wheel is provided with two receivers R1 and R2 and the base is provided with two transmitters Ea and Eb. A periodic calculation based on the travel time of signals between transmitters and receivers, is used to determine the variation of the angle of rotation of the steering wheel 14 with respect to the base 12, using mathematical calculations known to those skilled in the art. The electrical signals representative of this variation are applied to game or control simulator programs for controlling the virtual vehicle.

Figure 9 illustrates another input device 10, with a base 12 and a joystick 16 capable of pivoting about a hinge located at its base, along an x direction and along a y direction. The joystick is provided with a receiver R1 at a distance from its articulation point, while the base supports three transmitters EA, EB and EC. In this case, the variation of signal paths with time between the three transmitters and the receiver provides a means of determining the position of the joystick and how it is changing.

Obviously, the transmitters and the receivers in these embodiments could be reversed.

Many variants and modifications may be made to the invention.

However, in the case of a dedicated games console for which the display screen is an ordinary television set, the fixed transmitters or receivers and the associated processing electronics are preferably located

on the console itself, or in the form of a fixed element distinct from the said console but connected to it.